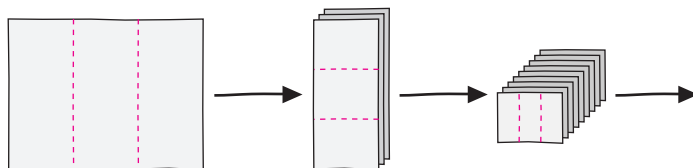


Applications

1. Cut a sheet of paper into thirds. Stack the three pieces and cut the stack into thirds. Stack all the pieces and cut the stack into thirds again.



- a. Copy and complete this table to show the number of ballots after each of the first five cuts.

Number of Cuts	Number of Ballots
1	3
2	■
3	■
4	■
5	■

- b. Suppose you continued this process. How many ballots would you have after 10 cuts? How many would you have after n cuts?
- c. How many cuts would it take to make at least one million ballots?

Write each expression in exponential form.

2. $2 \times 2 \times 2 \times 2$
3. $10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10$
4. $2.5 \times 2.5 \times 2.5 \times 2.5 \times 2.5$

Write each expression in standard form.

5. 2^{10}
6. 10^2
7. 3^9

8. You know that $5^2 = 25$. Use this fact to evaluate 5^4 .
9. The standard form for 5^{14} is 6,103,515,625. Use this fact to evaluate 5^{15} .
10. **Multiple Choice** Which expression is equal to one million?
 A. 10^6 B. 6^{10} C. 100^2 D. 2^{100}
11. Use exponents to write an expression for one billion (1,000,000,000).

Decide whether each number is greater or less than one million *without* using a calculator. Try to decide without actually multiplying. Explain how you found your answer. Use a calculator to check whether you are right.

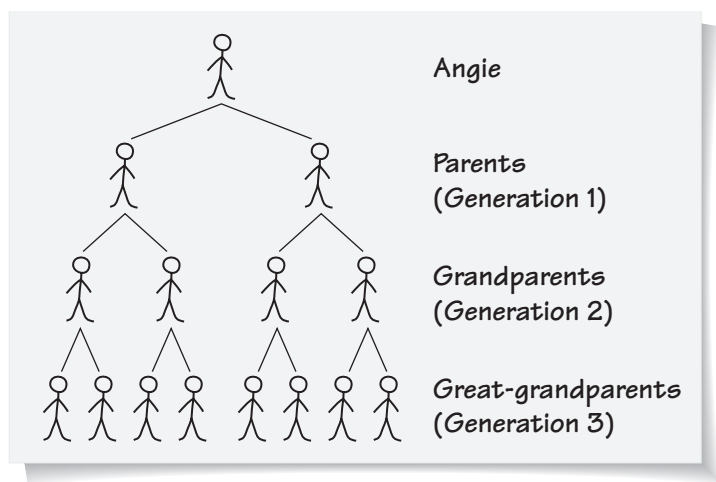
12. 9^6 13. 3^{10} 14. 11^6

For Exercises 15–20, write the number in exponential form using 2, 3, 4, or 5 as the base.

15. 125 16. 64 17. 81
 18. 3,125 19. 1,024 20. 4,096

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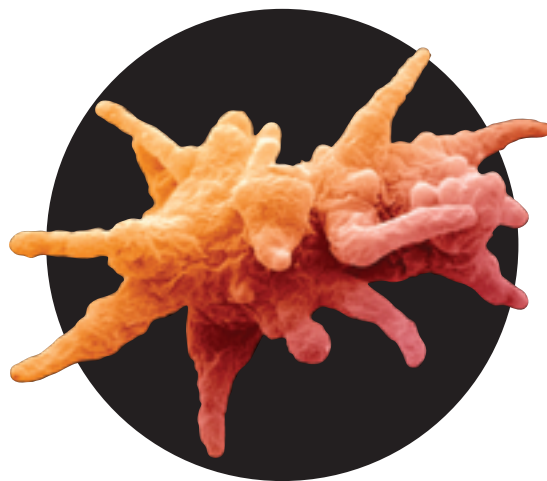
21. While studying her family's history, Angie discovers records of ancestors 12 generations back. She wonders how many ancestors she has had in the past 12 generations. She starts to make a diagram to help her figure this out. The diagram soon becomes very complex.



- a. Make a table and a graph showing the number of ancestors in each of the 12 generations.
- b. Write an equation for the number of ancestors a in a given generation n .
- c. What is the total number of ancestors in all 12 generations?

- 22.** Many single-celled organisms reproduce by dividing into two identical cells. Suppose an amoeba (uh MEE buh) splits into two amoebas every half hour.

- An experiment starts with one amoeba. Make a table showing the number of amoebas at the end of each hour over an 8-hour period.
- Write an equation for the number of amoebas a after t hours.
- After how many hours will the number of amoebas reach one million?
- Make a graph of the (*time, amoebas*) data from part (a).
- What similarities do you notice in the pattern of change for the number of amoebas and the patterns of change for other problems in this investigation? What differences do you notice?



- 23.** Zak's wealthy uncle wants to donate money to Zak's school for new computers. He suggests three possible plans for his donations.

Plan 1: He will continue the pattern in this table until day 12.

Day	1	2	3	4
Donation	\$1	\$2	\$4	\$8

Plan 2: He will continue the pattern in this table until day 10.

Day	1	2	3	4
Donation	\$1	\$3	\$9	\$27

Plan 3: He will continue the pattern in this table until day 7.

Day	1	2	3	4
Donation	\$1	\$4	\$16	\$64

- Copy and extend each table to show how much money the school would receive each day.
- For each plan, write an equation for the relationship between the day number n and the number of dollars donated d .
- Which plan would give the school the greatest total amount of money?
- Zak says there is more than one equation for the relationship in Plan 1. He says that $d = 2^{n-1}$ and $d = \frac{1}{2}(2^n)$ both work. Is he correct? Are there two equations for each of the other plans?

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